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Reference:
Comments on document "Flight Simulation Device Initial and Continuing Qualification and Use; Proposed Rule" (Docket No. **FAA-2002-12461; Notice No. 02-11**)

Comment 1

Page 60331, Paragraph 11 Motion System Tests
Page 60450, Paragraph 10 Motion System Tests

The use of different reference points may seem confusing at first but it does allow more freedom for the motion system manufacturer to meet the requirements which will allow for a more efficient design.

Comment 2

Page 60344, Paragraph 3 Motion System

The format of the requirements for the Motion System differs from the format in appendix C (page 60456 and 60457). This is confusing. Also, some requirements that are mentioned in appendix C (initial acceleration ratio, leg balance, turn around) are missing in appendix A.

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Comment 3

Page 60344, Paragraph 3.a Motion System, Minimum Excursion

The excursions for Roll, Pitch and Yaw are given as:
At least ± *value* °.
This must be a typing error and we assume that what is meant is:
At least *value* ° **total movement.**
This would be equivalent to the requirements mentioned in appendix C (page 60456).

Comment 4

Page 60345, Paragraph 3.d Motion System, Frequency Response

We have the following three remarks:
1. There is no requirement for the amplitude ratio
2. The requirement is more stringent than the one in appendix C (page 60457)
3. The requirement may be too stringent

Clarification
1. The purpose of the phase lag requirement is to improve the fidelity of the signals in the frequency range that is important for the control behavior of the pilot (around 2 Hz). Research by F. Cardullo et al. suggest that a low time delay and a low amplitude distortion ensures an adequate fidelity. The "low time delay" has made it into "Part 60" (45° at 4 Hz is equivalent to a 31 ms delay) but the "low amplitude distortion" has been lost somehow. The current proposal would allow a motion system manufacturer to use massive lead filtering to comply with the phase requirement. This will introduce enormous amplitude distortions (+10 dB or more) that would defeat the whole purpose of the requirement but that would still be legal. We suggest to add a requirement for the amplitude ratio.
2. The frequency response requirement for an airplane simulator (45° at 4 Hz) is more stringent than for a helicopter simulator (40° at 2 Hz). This is inconsistent because: a) it is generally accepted that the control of a helicopter requires a more responsive system than the control of an airplane and b) the transport delay that is allowed for a helicopter simulator (100 ms, page 60442) is **less** than what is required for an airplane simulator (150 ms, page 60322). With the current proposal, the motion system for an airplane simulator would be allowed to use 1/5th of the transport delay (31 ms vs 150 ms) while the motion system for a helicopter simulator would be allowed to use more than half of the transport delay (55 ms vs 100 ms). This is an indication that the requirement is not well-thought out. We suggest to make the requirement for the airplane simulator "lower" than for the helicopter simulator.
3. A maximum phase lag of 45° at 4 Hz (with an acceptable amplitude distortion) is a requirement that can only be reached by a few research simulators. Experience has shown that excellent results can be reached with a motion system that has 90° phase lag at approx. 3 Hz (and a maximum amplitude distortion of +0.5 dB).

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For questions or remarks on our remarks, please feel free to contact:

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